Baumer

Operating Instructions
Interface Description
N 155 Target Display
Program 01
From version 2.10

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1. General information

1.1 Safety precautions

General remarks
The equipment is designed and assembled according to the prevailing regulations of technology. The equipment left the manufacturer in perfect working order and in line with all safety-relevant conditions. To maintain this status of the equipment, it is imperative to stick to the following when installing and using the device:
- use only according to the intended purpose,
- observation of any precautions regarding safety and hazards,
- observe the present manual and especially the relevant safety precautions!

Make sure that the operating manual and especially the chapter describing the safety precautions is read and well understood by the staff in charge. Supplementary to the operating instructions, ad other generally or legally relevant regulations regarding accident prevention and environmental care are to be considered and observed. This manual is a supplement to already existing documentation (data sheet, mounting instructions, catalogues).

Intended purpose of the equipment
Intended purpose of the equipment is industrial process monitoring and control in metal, wood, plastic, paper, glass and textile etc. industry.
It is imperative that the equipment is applied only
- in properly installed condition and
- in line with the relevant technical data!

⚠ Any operation outside the technical specifications/parameters is improper use and in conjunction with the equipment/processes/machines to be monitored/controlled might lead to
- fatal injuries
- serious damage to health,
- damage to property or corporate equipment or
- damage to the device!

Any overvoltage the device might be exposed to at its connecting terminals has to be limited to the values stipulated in overvoltage category II (see technical data).

The device must not be operated
- in hazardous areas where is danger of explosion,
- as medical equipment or in medical areas,
- or in any applications expressly named in EN 61010!

⚠ If the device is utilized for control/monitoring of machines or processes where as the result of a failure/malfunction or incorrect operation of the device might occur
- any threats to life,
- risks of damage to health or
- any risk of damage to property or environment
the corresponding appropriate safety precautions must be taken!

Do not open the housing of the device or proceed any modifications! Any modifications of the device can affect operating safety and result in danger!
Do not proceed any repairs but return defective devices to the manufacturer!

Installation/commissioning
In case of any extraordinary incidents (including in the operating behaviour) that impair safety switch off the device immediately.
Installation must be carried out by suitably trained experts only. After proper mounting and installation the device is ready for operation.

Maintenance/repairs
Always disconnect the power supply of all appliances involved. Maintenance and repair work must only be carried out by suitably trained experts.
If troubleshooting is unsuccessful, do not continue using the device but contact the manufacturer.

1.2 Description

Mounting the target display is by using the attached mounting plate that is fixed at the machine by using two screws. The target display can be hooked onto the brackets provided at the mounting plate.
The position data will not get lost even in case of power failure (min. 10 years).
The current position value is indicated as running value in the two-line LCD display with backlight (2 x 5 digits, numeric). Optionally the target received by the control unit (master) can be indicated simultaneously in the same display. Two arrows show the editing engineer the turning direction in order to align current value with target. As soon as the current value is in coincidence with the target and within the tolerance window, the target will disappear. Programming the relevant parameters at the master enables the display to be turned by 180° to allow vertical installation of the target display. Connecting the target display is by the help of an M8 connector. Power supply of all target displays connected is by the same cable directly by master. Programming of target display by master only.

target display

arrows indicating the direction

display „current value"

enter key
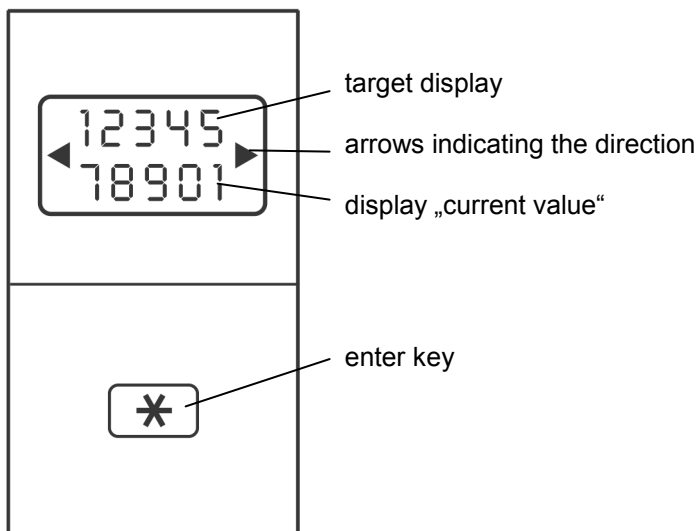
2. Pin assignment

Terminal	Assignment	Wire color DIN47100	IEC757
Pin 1	Tx/Rx-, RS485	white	orange
Pin 2	Tx/Rx+, RS485	brown	brown
Pin 3	sensor supply +24 V	yellow	red
Pin 4	sensor supply 0 V	green	black
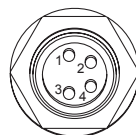
connector M8
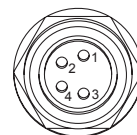
mating connector M8

Terminal	Assignment	**Wire color** DIN47100	IEC757
Pin 1	sensor supply +24 V	yellow	red
Pin 2	sensor supply 0 V	green	black
Pin 3	--	--	--
Pin 4	Tx/Rx+, RS485	brown	brown
Pin 5	Tx/Rx-, RS485	white	orange
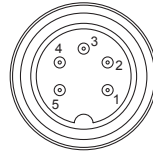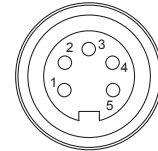
connector M16   mating connector M16

Connect power supply that is free from interference emission. The supply must not be used as parallel supply of drives, shields, magnetic valves, etc.
Apply DC according to terminal assignment power supply: 24 VDC ±10 %

Shield
Use shielded cables only. The cable shield must be grounded at the machine
(two examples each depending on the cable, see drawings).

3. Interface

3.1 Interface data

Type:	RS485
Baud rate:	19200
Parity:	No
Data bits:	8
Stop bits:	1
Handshake:	No
Check sum:	Yes (CRC)
Lag time response*:	1...16 ms

* To avoid Bus collisions, a minimum time lag in responding of 1 ms is imperative, i.e. the time elapsed between the last bit of the query and sending the 1st bit of the N 155 response.
Important: Please consider that due to the abovementioned minimum time lag of 1 ms in responding the Bus switching time after having sent the last bit must not exceed 1 ms.

3.2 Protocol

The target display operates with ASCII protocol (clear text protocol). Depending on the command, the volume of the protocol varies between 5 and 17 bytes.
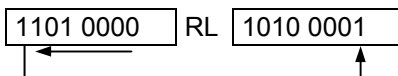
Byte	Hex-Code	Significance	Value range
1	01H	SOH = header token	fix on 01h
2	XXh	Adr = address	00...31dez + 20h Offset (address 00 = 20h)
3	XXh	Cmd = command code	defined commands
4-n	[XXh..XXh]	[Data] = data	20h-7Fh
n+1	04h	EOT = footer token	fix on 04h
n+2	XXh	CRC = check sum	00h...FFh

3.3   Check sum

To support an error-free data transmission, a check sum byte CRC is added after the footer token (EOT) to the string to be transferred. Upon reception of a command the CRC byte received is crosschecked with the self-calculated CRC byte.

Algorithm:
1) Reset check sum byte.
2) Rotate check sum byte by 1 bit to the left.
3) Link result to first data byte XOR.
4) Rotate result by 1 bit to the left.
5) Link result to the second data byte XOR.
    :
x) Rotate result by 1 bit to the left.
y) Link result to the last data byte (always 04H) XOR.
z) Add result as CRC after the footer token (04H) to the sending string.

Note: | 1101 0000 | RL | 1010 0001 | Important: Bit 7 is being shifted into bit 0 during rotation

Example:
Transmission string w/o CRC   = 01h 20h 43h 04h
CRC-Byte   = 0Ah

| 0000 0000 | RL | 0000 0000 | XOR | 0000 0001 (01h) | = | 0000 0001 |

| 0000 0001 | RL | 0000 0010 | XOR | 0010 0000 (20h) | = | 0010 0010 |

| 0010 0010 | RL | 0100 0100 | XOR | 0100 0011 (43h) | = | 0000 0111 |

| 0000 0111 | RL | 0000 1110 | XOR | 0000 0100 (04h) | = | **0000 1010** | = CRC

Legend: RL = rotate left;   XOR = non-equivalence link

3.4   Special features in data transfer

For reasons of compatibility and independent from the number of digits provided in the display, the complete multicon system features the same data volume (refer to chart „overview of commands). For example, command "R" (read current value) comprises 6 bytes as data volume to be transferred whilst it is a 5-digit display only.

3.5   Broadcast commands

Some specific commands are defined as so-called broadcast commands. As soon as such a command is sent by master to identifier 99, the command will be accepted by each N 155 in the network. Each individual target display will accomplish the respective function but will not return any confirmation to the master.

4. Description of commands

4.1   General information

The following is describing the individual interface commands broken down into the four groups below:

- operating commands   [commands required during operation]
- parameter commands   [commands serving for parameterization]
- identifier commands [commands for indication or alteration of the device identifier (address)]
- specific commands   [commands for specific functions as device reset or read version number]

The following abbreviations will be applied:

SOH   = Start of header (header token)
EOT= End of transmission (footer token)
Adr = device identifier including offset 20h
Cmd   = Command
data = data being sent or received

4.2   Operating commands

4.2.1 Read current value „R" (52h)

This command is for reading the 5-digit current value (lower display line). Data volume is always 6 bytes. In case of a negative value, the negative "-" sign (2Dh) together with 5 data bytes will be returned. Positive values are depicted by 6 data bytes without sign. Values of less than 5 (4) digits will come with preceding zeroes. Please note that the current value is always of 5 digits (refer also to chapter "Special features in data transfer").

Example 1: Read current value (current value = -32.50

Send	SOH	Adr	Cmd	EOT	CRC
	01h	20h	52h	04h	40h

Response	SOH	Adr	Cmd	current value = -32.50						EOT	CRC
	01h	20h	52h	**2Dh**	**30h**	**33h**	**32h**	**35h**	**30h**	04h	54h

Example 2 Programming the current value (new current value = 75.50)

Send	SOH	Adr	Cmd	current value = 75.50						EOT	CRC
	01h	20h	52h	**30h**	**30h**	**37h**	**35h**	**35h**	**30h**	04h	C9h

Response	SOH	Adr	Cmd	current value = 75.50						EOT	CRC
	01h	20h	52h	**30h**	**30h**	**37h**	**35h**	**35h**	**30h**	04h	C9h

4.2.2. Read / write target (profile) „S" (53h)

This command is for reading the presently active target or for programming respectively reading a specific target. The data are composed of profile number (2 bytes) and target (6 bytes). Important: Negative targets are transferred as 5 digit numbers (see example no. 3). Please consider that the targets are always of 5 digits only.

Example 1: Read active target (current profile number = 12; target = 12.50)

Send	SOH	Adr	Cmd	EOT	CRC
	01h	20h	53h	04h	2Ah

Response	SOH	Adr	Cmd	Profil-Nr. = 12		target = 12.50						EOT	CRC
	01h	20h	53h	**31h**	**32**	**30h**	**30h**	**31h**	**32h**	**35h**	**30h**	04h	3E

Response upon clearing all targets:

Response	SOH	Adr	Cmd	Profil-Nr. = FFh		target = FFFFFFh						EOT	CRC
	01h	20h	53h	**3Fh**	**3Fh**	**3Fh**	**3Fh**	**3Fh**	**3Fh**	**3Fh**	**3Fh**	04h	2Ah

Example 2: Read target of a specific profile (profile number = 17; target = 12.50)

Send	SOH	Adr	Cmd	Profil-Nr. = 17		EOT	CRC					
	01h	20h	53h	**31h**	**37h**	04h	16h					

Response	SOH	Adr	Cmd	Profil-Nr. = 17		target = 12.50						EOT	CRC
	01h	20h	53h	**31h**	**37h**	30h	30h	**31h**	**32h**	**35h**	**30h**	04h	BCh

Example 3: Write target of specific profile (profile number = 17; target = -12.50)

s

Send	SOH	Adr	Cmd	Profil-Nr. = 17		target = -12.50						EOT	CRC
	01h	20h	53h	**31h**	**37h**	**2Dh**	30h	**31h**	**32h**	**35h**	**30h**	04h	FBh

Response	SOH	Adr	Cmd	Profil-Nr. = 17		target = -12.50						EOT	CRC
	01h	20h	53h	**31h**	**37h**	**2Dh**	30h	**31h**	**32h**	**35h**	**30h**	04h	FBh

4.2.3 Read / write profile number „V" (56h)

This command is for reading the number of the presently active profile respectively for altering the profile.

Example 1: Read active profile (active profile number = 38)

Send	SOH	Adr	Cmd	EOT	CRC
	01h	20h	56h	04h	20h

Response	SOH	Adr	Cmd	Profile no. = 38		EOT	CRC
	01h	20h	56h	**33h**	**38h**	04h	28h

Response after reset upon clearing all profiles:

Response	SOH	Adr	Cmd	Profile no. = FF		EOT	CRC
	01h	20h	56h	**3Fh**	**3Fh**	04h	16h

Example 2: Send new profile (New profile number = 17)

Send	SOH	Adr	Cmd	Profile no. = 17		EOT	CRC
	01h	20h	56h	**31h**	**37h**	04h	3E

Response	SOH	Adr	Cmd	Profile no. = 17		EOT	CRC
	01h	20h	56h	**31h**	**37h**	04h	3E

Example 3: Send new profile by broadcast command to each N 155 (Adr = 99 (83h); new profile number = 17)

Send	SOH	Adr	Cmd	Profile no. = 17		EOT	CRC
	01h	83h	56h	**31h**	**37h**	04h	04

Response	No confirmation

To check whether the new profile has been entered by all N 155 in the network, check command „C" (43h) can be applied.

4.2.4 Check position „C" (43h)

This command is providing the alignment status of target versus current value. If current value is in coincidence with target the response will be „o" (6Fh) for OK together with the current profile number. If the running value is beyond the target, „x" (78H) followed by the current profile number will be replied.

Example: (active profile number = 05)

Send	SOH	Adr	Cmd	EOT	CRC
	01h	20h	43h	04h	0Ah

Response if current value = target:

Response	SOH	Adr	Cmd	Status	Profile no. = 05		EOT	CRC
	01h	20h	43h	**6Fh**	**30h**	**35h**	04h	A5h

Response if current value ≠ target:

Response	SOH	Adr	Cmd	Status	Profile no. = 05		EOT	CRC
	01h	20h	43h	**78h**	**30h**	**35h**	04h	1D

The following state-related values are available:

State	Significance
o (6Fh)	current value=target
x (78h)	current value≠ arget

Extended command Check Position „CX"

Besides the state value of the target/current value comparison, the extended command „Check Position" reads out the current value. The profile number is not transmitted. Regarding available state-related values please see above.

Example:

transmission	SOH	Adr	Cmd	SCmd	EOT	CRC							
	01h	20h	43h	58h	04h	A8h							

Response	SOH	Adr	Cmd	state	reserved		reserved		Current value = -12.50						EOT	CRC
	01h	20h	43h	**6Fh**	**80h**	**80h**	**80h**	**80h**	**2Dh**	**30h**	**31h**	**32h**	**35h**	**30h**	04h	B7h

4.2.5 Read / write offset „U" (55h)

This command is for reading or writing the offset to be added to the actual current value. This function however has to be activated first in the command bit parameter ‚a' (61h).

Example 1: Read offset

Send	SOH	Adr	Cmd	EOT	CRC
	01h	20h	55h	04h	26h

Example 2: Write offset

Send	SOH	Adr	Cmd	data (offset = –20.00)						EOT	CRC
	01h	20h	55h	**2Dh**	**30h**	**32h**	**30h**	**30h**	**30h**	04h	C3h

Response in both examples:

Response	SOH	Adr	Cmd	data (offset = –20.00)						EOT	CRC
	01h	20h	55h	**2Dh**	**30h**	**32h**	**30h**	**30h**	**30h**	04h	C3h

4.2.6. Write a number sequence in upper line of the display „t" (74h)

The command is for writing a 5-digit number sequence in the upper display line. The sequence is depicted without dot respectively comma. Preceding zeroes as well as both arrows for direction are hidden. The bottom line is still showing the current value.
The number sequence will remain until any command except „t", „u" or „R" is received by interface.

Example: (number sequence = 054321)

Send	SOH	Adr	Cmd	Number sequence = 054321						EOT	CRC
	01h	20h	74h	**30h**	**35h**	**34h**	**33h**	**32h**	**31h**	04h	C6h

Response	SOH	Adr	Cmd	Number sequence = 054321						EOT	CRC
	01h	20h	74h	**30h**	**35h**	**34h**	**33h**	**32h**	**31h**	04h	C6h

4.2.7 Write a number sequence in the lower line of the display „u" (75h)

The command is for writing a 5-digit number sequence in the lower display line. The sequence is depicted without dot respectively comma. Preceding zeroes as well as both direction arrows are hidden. The upper line is still showing the current target or number sequence.
The number sequence will remain until any command except „t", „u" or „R" is received by the interface.

Example: (number sequence = 012345)

send	SOH	Adr	Cmd	Number sequence = 012345						EOT	CRC
	01h	20h	75h	**30h**	**31h**	**32h**	**33h**	**34h**	**35h**	04h	B6h

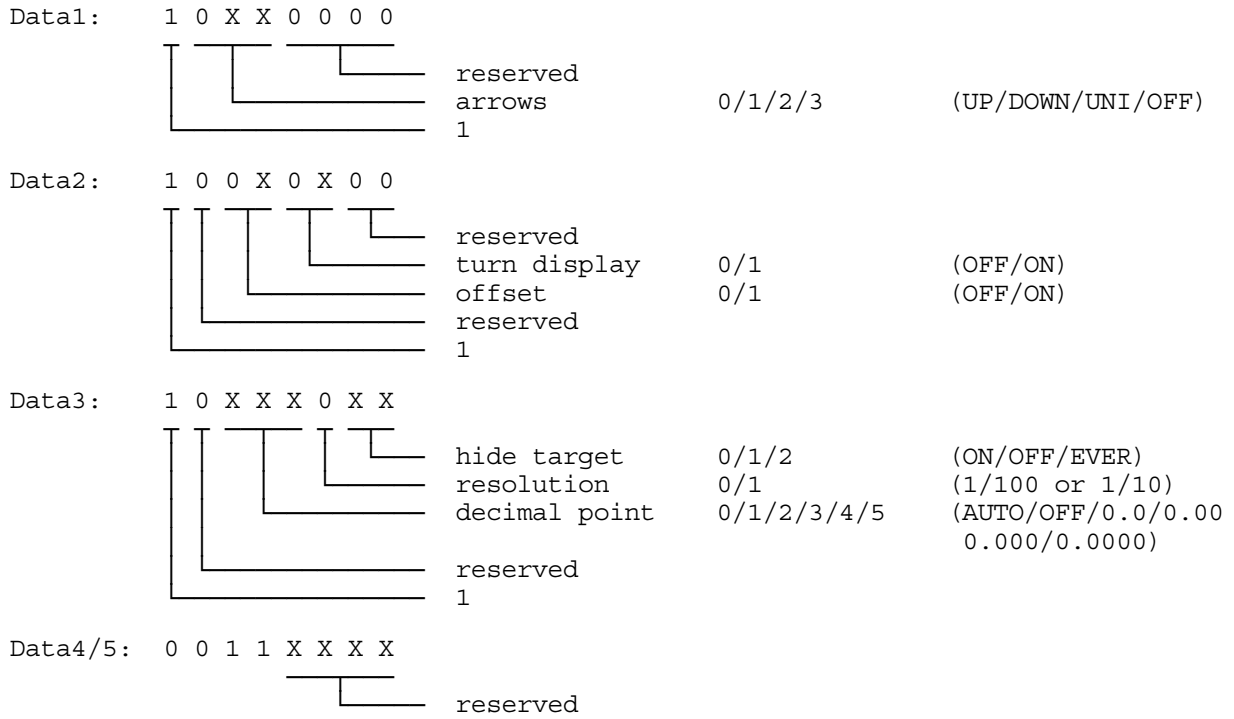| response	SOH	Adr	Cmd	Number sequence = 012345						EOT	CRC
	01h	20h	75h	**30h**	**31h**	**32h**	**33h**	**34h**	**35h**	04h	B6h

Important:
Combining the commands „t" and „u" enables a 10-digit number in the display.
Both number sequences are not saved by EEPROM.

4.3   Parameter commands and their significance

4.3.1 Read / write bit parameters „a" (61h)

To exploit the maximum storage capacity, several parameters are put together and transferred as "pack". Parameter codes as follows:

```
Data1:    1 0 X X 0 0 0 0
                │ │ │   │
                │ │ └───┴────── reserved
                │ └─────────── arrows            0/1/2/3        (UP/DOWN/UNI/OFF)
                └───────────── 1

Data2:    1 0 0 X 0 X 0 0
                │ │ │ │
                │ │ │ └──────── reserved
                │ │ └───────── turn display      0/1            (OFF/ON)
                │ └─────────── offset            0/1            (OFF/ON)
                └───────────── reserved
                               1

Data3:    1 0 X X X 0 X X
                │ │ │   │ │
                │ │ │   └─┴──── hide target       0/1/2          (ON/OFF/EVER)
                │ │ │           resolution        0/1            (1/100 or 1/10)
                │ │ └───────── decimal point     0/1/2/3/4/5    (AUTO/OFF/0.0/0.00
                │ │                                               0.000/0.0000)
                │ └─────────── reserved
                └───────────── 1

Data4/5:  0 0 1 1 X X X X
                    │   │
                    └───┴────── reserved
```

Important: Only bits marked 'X' may be altered. The fix values „1" and „0" must not be altered since thereby a control token (tokens < 20h) might be created what is not allowed in ASCII protocol.

Example 1: Read bit-parameters (Data1 to Data3 = 80h; Data4 to Data5 = 30h)

Send	SOH	Adr	Cmd	EOT	CRC
	01h	20h	61h	04h	4E

Response	SOH	Adr	Cmd	Data1	Data2	Data3	Data4	Data5	EOT	CRC
	01h	20h	61h	**80h**	**80h**	**80h**	**30h**	**30h**	04h	F1

Bit parameter default

Example 2: Write bit parameters (positioning direction = Down; turn display = On)

Send	SOH	Adr	Cmd	Data1	Data2	Data3	Data4	Data5	EOT	CRC
	01h	20h	61h	**81h**	**84h**	**80h**	**30h**	**30h**	04h	91h

Response	SOH	Adr	Cmd	Data1	Data2	Data3	Data4	Data5	EOT	CRC
	01h	20h	61h	**81h**	**84h**	**80h**	**30h**	**30h**	04h	91h

Parameter significance

Arrows
This parameter is for displaying arrows intended as support for the editing engineer. They indicate the direction for the new setting (clockwise or counter clockwise, up or down). The following settings are possible

00 = Up	If current value < target: arrow at the right; current value > target: arrow at the left
01 = Down	Similar to „Up", but direction of the arrows the other way round
10 = Uni	If current value ≠ target: always indicate both arrows
11 = Off	Arrows always hidden

Turn display

This parameter is for turning the display by 180°.

0 = Off	Display with standard mounting, i.e. display on top, key below
1 = On	Display with inverted mounting, i.e. display below, key on top

Offset

The „U" command is for programming the offset to be added to current value and relevant target. This parameter is for defining whether the offset is to be considered in the calculation.

0 = Off	Offset not active. Any transferred offset is <u>not</u> added to current value nor target.
1 = On	Offset active. The offset is added to current value and target.

Hide target

This parameter is for defining when to indicate the target in the upper line of the display.

0 = On	Always show target if target ≠ current value.
1 = Off	Always show target, even if target = current value. Indicate in addition arrows if target ≠ current value.
2 = Ever	Always hide both target and arrows.

Resolution

This parameter defines the resolution related to the current value. Switching to another resolution will relocate the decimal point accordingly by one digit to the right or left, both for current value and target. The targets however are not calculated anew but only the decimal point is relocated. Make sure that during the machine editing procedure the resolution is defined first and the target values are transmitted to the SPAs afterwards when having selected the resolution. When switching from mm to inch, the decimal point is displaced by one digit to the left. Both current value and target are converted into inches. See also command "I" for mm/inch-conversion.

Note: This function is only enabled if parameter *decimal point= auto*.

0	Resolution 1/100 of a mm resp. 1/1000 of an inch 00.000 inch	Displayed: 000.00 mm resp.
1	Resolution 1/10 of a mm resp. 1/100 of an inch 000.00 inch	Displayed: 0000.0 mm resp.

Decimal point

This parameter is for setting the decimal point.

000 = Auto	The resolution function (see above) is active, this means the decimal point is automatically placed according to the resolution parameter.	
001 = Off	No decimal point is indicated, neither when switching from mm to inch.	
010 = 0.0	Fix decimal point for current value and target. No automatic setting of decimal point when switching from mm to inch. The decimal point remains at the defined digit.	
011 = 0.00	Same as with 0.0	
100 = 0.000	Same as with 0.0	
101 = 0.0000	Same as with 0.0	

4.3.2. Read / write measuring unit „i" (69h)

This command is for reading or programming the measuring unit in mm or inches.

Data = 0 (30h) = mm
Data = 1 (31h) = inch

Example 1: Read parameters (setting = mm)

Send	SOH	Adr	Cmd	EOT	CRC
	01h	20h	69h	04h	5E

Response	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	69h	**30h**	04h	D0h

Example 2: Changing the measuring unit into inch

Send	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	69h	**31h**	04h	D2

Response	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	69h	**31h**	04h	D2

Example 3: Programming mm as measuring unit with all target displays by broadcast command (Adr=99)

Send	SOH	Adr	Cmd	Data	EOT	CRC
	01h	83h	69h	**30h**	04h	CDh

Response	No confirmation

Important: Parameter programming is in mm. The target display will convert the mm into inches when displaying the position values.

4.4 Identifier commands

4.4.1. Placing a device-specific identifier within the network „A" (41h)

This command is for creating an automated process for defining successively the device identifier of each individual N 155 upon commissioning of the equipment. The first device identifier to be placed is given by broadcast command to all networked N 155 as follows:

send	SOH	Adr	Cmd	address = 01		EOT	CRC
	01h	83h	41h	**30h**	**31h**	04h	B4h

All N 155 will now show the identifier to be set which has just been sent in the upper line of the display. The lower line will indicate the device-specific identifier. Push key provided at N 155 to enter the new identifier. The identifier is entered and indicated in the lower line of the display (as new device identifier). Both identifiers are now identical. After 3 seconds N 155 will send the following confirmation „B" (42h) to the master:

Send to Master	SOH	Adr	Cmd	address = 01		EOT	CRC
	01h	21h	42h	**30h**	**31h**	04h	86h

The Master now is able to give command „A" with the next identifier to be placed as previously described.
This way, all N 155 in the network are automatically given the specific identifier (in successive order).

Important: The confirmation command „B" sent by N 155 to the master will be repeated after 3 seconds in case the master is not giving the „A" command again.

Show identifier in the display „A" (41h)

This command as broadcast command (Adr = 99) without any parameters will make each N 155 in the network indicating the device-specific identifier in the bottom line of the display. The upper line is blind.
This command is a designated broadcast command.

Send	SOH	Adr	Cmd	EOT	CRC
	01h	83h	41h	04h	80h

Response	no confirmation

N 155 remains in this mode until being switched off and on again or receiving another command except „A", „R", „t" or „u".

If this command without any parameters is sent to a valid device identifier (except 99), the target display will return to standard operation mode. The presently valid device identifier will be replied.

Send	SOH	Adr	Cmd	EOT	CRC
	01h	21h	41h	04h	0Ah

Response	SOH	Adr	Cmd	Adr=01		EOT	CRC
	01h	21h	41h	**30h**	**31h**	04h	9Eh

Extended identifier command „AX" (41h,58h)

This command is for placing the individual N 155 device identifiers in a way as previously described.
The identifier to be given is sent to all N 155 in the network by the following broadcast command:

Send	SOH	Adr	Cmd	Cmd2	address = 01		EOT	CRC
	01h	83h	41h	58h	**30h**	**31h**	04h	40h

Similar to the standard command, the upper line of the N 155 display will show the identifier to be placed that has just been sent. Also entering the identifier will be the same.
However, in this case NO identifier confirmation command „B" is returned. Whether the identifier has been entered or not has to be checked by master, for example by "R" command (read current value). The "R" command is sent to the N 155 with corresponding identifier. If the identifier is entered, the target display will reply and the master can pass on to the next identifier. Regarding other commands the N 155 display will switch to standard operation.

4.5 Specific commands

4.5.1. Read version, device type or serial number „X" (58h)

This command is for reading off version number, device type or serial number. The following sub-commands are available:

Data = V (56h) = read off version number
Data = T (54h) = read off device type
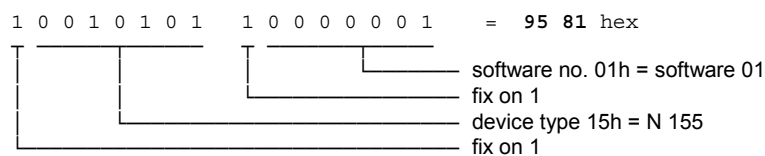Data = S (53h) = read off serial number

Example 1: Read version number

Send	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	58h	**56h**	04h	D8h

Response	SOH	Adr	Cmd	Data	Version number = 2.00			EOT	CRC
	01h	20h	58h	56h	**20h**	**32h**	**30h**	**30h**	04h	FAh

Example 2: Read device type (device type = N 155; software no. = 01)

Send	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	58h	**54h**	04h	DCh

Response	SOH	Adr	Cmd	Data	type		EOT	CRC
	01h	20h	58h	54h	**95h**	**81h**	04h	32h

Structure of the transferred device type code:

```
1 0 0 1 0 1 0 1   1 0 0 0 0 0 0 1    =  95 81 hex
```
— software no. 01h = software 01
— fix on 1
— device type 15h = N 155
— fix on 1

Example 3: Read serial number

Send	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	58h	**53h**	04h	D2h

Response	SOH	Adr	Cmd	Data	Serial number code = 07090EA4								EOT	CRC
	01h	20h	58h	53h	**30h**	**37h**	**30h**	**39h**	**30h**	**3Eh**	**3Ah**	**34h**	04h	20h

Structure of the serial number code transferred:

The Low-Nibble (lower 4 bits of a byte) of the 8 data bytes received equal together a 4-byte value including the serial number.
The serial number itself is generated by production date and time. Since also the seconds are coded and only one number is created per second the serial number is unique.

Example: serial number for production date and time **01.06.2005 16:58:36 = 15 83 0E A4** hex

```
X X X X X X X X   X X X X X X X X   X X X X X X X X   X X X X X X X X    Bit position
J J J J J J M M   M M T T T T T h   h h h h m m m m   m m s s s s s s    content
0 0 0 1 0 1 0 1   1 0 0 0 0 0 1 1   0 0 0 0 1 1 1 0   1 0 1 0 0 1 0 0    example = 15 83 0E A4 hex
```
— seconds 10 0100 = 24h = **36d**
— minutes 11 1010 = 3Ah = **58d**
— hours   1 0000 = 10h = **16d**
— day   0 0001 = 01h = **01d**
— month   0110 = 06h = **06d**
— year 00 0101 = 05h = **05d**

01.06.05 16:58:36 ←
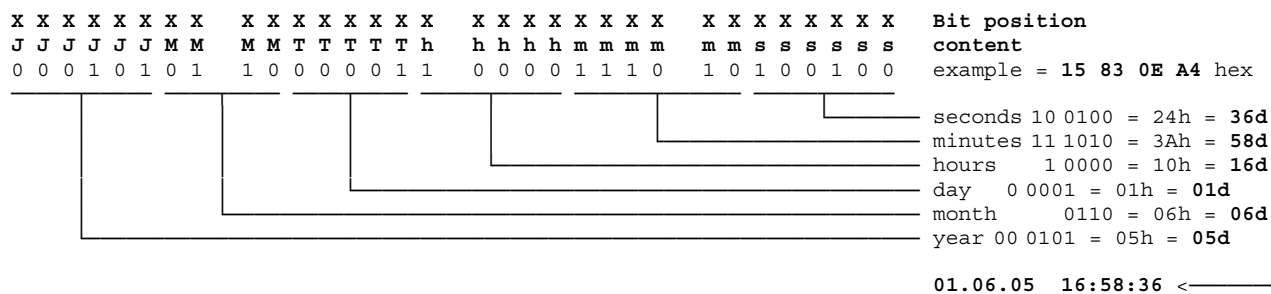
4.5.2. N 155 reset to default „Q" (51h)

This command is for resetting several parameters to default, either by individual or collective reset.

Data = q (71h) = reset parameters to default
Data = t (74h) = reset device identifier to 98.
Data = x (78h) = reset current value (lower line of display) to 0
Data = Δ (7Fh) = all above functions except „r" (72h) are accomplished.

Note: No profile reset. Profile reset by command „R".

Example 1: Reset N 155 to default

Send	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	51h	**7Fh**	04h	AEh

Response	SOH	Adr	Data	EOT	CRC	
	01h	20h	**6Fh**	04h	52h	N 155 replies by standard response ‚o' (6Fh) = OK

Example 2: Reset all N 155 to default by broadcast command (Adr=99)

Send	SOH	Adr	Cmd	Data	EOT	CRC
	01h	83h	51h	**7Fh**	04h	B3

Response	no confirmation

4.5.3. Profile reset of the target display „K" (4Bh)

This command is clearing all prior profiles.

Example 1: Profile reset in a specific N 155

Send	SOH	Adr	Cmd	Data	EOT	CRC
	01h	20h	4Bh	**7Fh**	04h	C6h

Response	SOH	Adr	Data	EOT	CRC	
	01h	20h	**6Fh**	04h	52h	N 155 standard reply ‚o' (6Fh) = OK

Example 2: Profile reset with all N 155 by broadcast command (Adr=99)

Send	SOH	Adr	Cmd	Data	EOT	CRC
	01h	83h	4Bh	**7Fh**	04h	DBh

Response	No confirmation

Important: After profile reset all profile data are set to auf FFFFFFhex respectively FFhex (current profile number). The display will show 5 dashes instead of the target.

5. Error signals

5.1 CRC error

If the target display recognises a CRC error in a command transferred, the following signal will be replied:

Response	SOH	Adr	Error	EOT	CRC
	01h	20h	65h	04h	46h

Error = „e" (65h) = CRC error

5.2 Format error

If the target display recognises a format error i.e. volume of protocol incorrect or invalid command (Cmd); the following signal will be replied:

Response	SOH	Adr	Error	EOT	CRC
	01h	20h	66h	04h	40h

Error = „f" (66h) = Format error

6. Overview of commands

The following chart is showing in alphabetical order all possible commands (Cmd) as well as options regarding read and write (programming) etc.

Command code	Data volume in bytes	Read	Write	Broadcast	Significance
a (61h)	5	X	X	-	Read/write general parameters
i (69h)	1	X	X	X	Parameter: mm / inch
t (74h)	6	-	X	-	Send tool number
u (75h)	6	-	X	-	Send any number sequence
A (41h)	2	X	X	X	Place or indicate device identifier
C (43h)	3	X	-	-	Check current value = target
K (4Bh)	-	-	X	X	Profile reset
Q (51h)	1	-	X	X	Specific command: reset N 155
R (52h)	6	X	X	-	Read/write current value
S (53h)	8	X	X	-	Read/write target
U (55h)	6	X	X	-	Offset
V (56h)	2	X	X	X	Read/write profile number
X (58h)	4	X	-	-	Specific command: read version number

7. Technical data

Technical data - electrical ratings

Supply voltage	24 VDC ±10 %
Current consumption	≤30 mA
Display	LCD, 7-segment display, 2-lines, backlit
Display range	-9999...+99999
Interface	RS485 (ASCII protocol)
Data memory	>10 years in EEPROM
Programmable parameters	Measuring unit mm/inch
	Direction arrows
	Decimal point
Standard DIN EN 61010-1	Overvoltage category II
	Protection class II
	Pollution degree 2
Emitted interference	DIN EN 61000-6-3
Interference immunity	DIN EN 61000-6-2
Approval	UL/cUL

Technical data - mechanical design

Protection DIN EN 60529	IP 65
Operating temperature	-10...+50 °C
Storing temperature	-20...+70 °C
Relative humidity	80 % non-condensing
E-connection	- Male/female connector M8, 4-pins
	- Cable output (30/15 cm) with male/female connector M8, 4-pins
	- Cable output (30/15 cm) with male/female connector M16, 5-pins
Operation / keypad	Membrane with one softkey (handshake)
Housing type	Surface mount housing with mounting plate
Dimensions W x H x L	37 x 75 x 29 mm
Mounting	Mount onto plate
Weight approx.	60 g
Material	Polyamide black, UL 94V-0